What is claimed is:

1. A method for forming low defect density epitaxial layers on lattice-mismatched substrates, comprising the steps of:

a) choosing a first epilayer and a top substrate layer for epitaxial growth;

b) determining a first lattice constant and a first thermal expansion coefficient of said first epilayer;

c) determining a second lattice constant and a second thermal expansion coefficient of said top substrate layer;

d) bonding an additional substrate layer to said top substrate layer to form a composite substrate so that said first epilayer has either positive lattice mismatch and negative or zero thermal mismatch to said composite substrate, or negative lattice mismatch and positive or zero thermal mismatch to said composite substrate; and

e) choosing a buffer layer which is lattice matched to said first epilayer to be deposited on said composite substrate before depositing said first epilayer, wherein

said buffer layer has positive thermal mismatch to said composite substrate when said buffer layer and said top substrate layer have positive lattice mismatch, and

said buffer layer has negative thermal mismatch to said composite substrate when said buffer layer and said top substrate layer have negative lattice mismatch.

2. A method according to claim 1, further comprising the steps of:

growing said buffer layer on said composite substrate;

thermally annealing said buffer layer and composite substrate when said buffer layer reaches a thickness of a bending radius of at least a majority of threading dislocations present in said buffer layer; and

repeating the steps of growing and thermally annealing until an aggregate buffer layer thickness is above said bending radius of all threading dislocations present in said buffer layer.

3. A method according to claim 2, wherein said buffer layer is grown on said top substrate layer.

4. A method according to claim 2, wherein said buffer layer is grown on said additional substrate layer.

5. A method according to claim 2, further comprising the step of growing said first epilayer on said buffer layer.

6. A method according to claim 5, further comprising the step of growing a second epilayer on said first epilayer.

7. A method according to claim 1, wherein said top substrate layer is of a material selected from the group consisting of GaP, Si, and Ge.

8. A method according to claim 7, wherein said additional substrate layer is of a material selected from the group consisting of InP, Ge, and Si.

9. A method according to claim 8, wherein said buffer layer is of a material selected from the group consisting of AlGaAs, InAlAs, and InGaAs.

10. A method according to claim 9, wherein said first epilayer is of a material selected from the group consisting of AlInGaP and InP.

11. A method according to claim 10, wherein said second epilayer is InP-based.

12. A method for forming low defect density epitaxial layers on lattice-mismatched substrates, comprising the steps of:

a) choosing a first epilayer and a substrate for epitaxial growth;

b) determining a first lattice constant and a first thermal expansion coefficient of said first epilayer;

c) determining a second lattice constant and a second thermal expansion coefficient of said substrate;

d) ensuring that said first epilayer has either positive lattice mismatch and negative or zero thermal mismatch to said substrate, or negative lattice mismatch and positive or zero thermal mismatch to said substrate; and

e) choosing a buffer layer which is lattice matched to said first epilayer to be deposited on said substrate before depositing said first epilayer, wherein

said buffer layer has positive thermal mismatch to said substrate when said buffer layer and said substrate have positive lattice mismatch, and

said buffer layer has negative thermal mismatch to said substrate when said buffer layer and said substrate have negative lattice mismatch.

13. A method according to claim 12, further comprising the steps of:

growing said buffer layer on said substrate;

thermally annealing said buffer layer and substrate when said buffer layer reaches a thickness of a bending radius of at least a majority of threading dislocations present in said buffer layer; and

repeating the steps of growing and thermally annealing until an aggregate buffer layer thickness is above said bending radius of all threading dislocations present in said buffer layer.

14. A product made according to the method of claim 1.

15. A product made according to the method of claim 2.

16. A product made according to the method of claim 12.

17. A product made according to the method of claim 13.